The content of this note is based on information received from manufacturers in the electrical and electronics industries or their representatives and does not imply practical experience by Elektor Electronics or its consultants.

MCP120/130

Microcontroller Supervisor

Most of today's microcontroller based applications need some protection against low power conditions that can cause many different system problems.

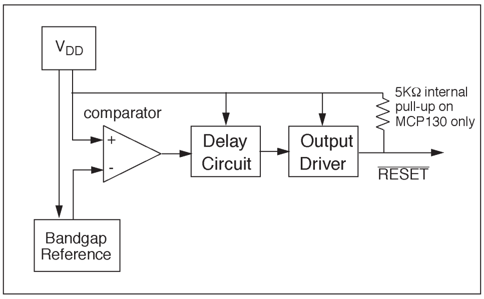


Figure 1. Block diagram of the MCP1x0.

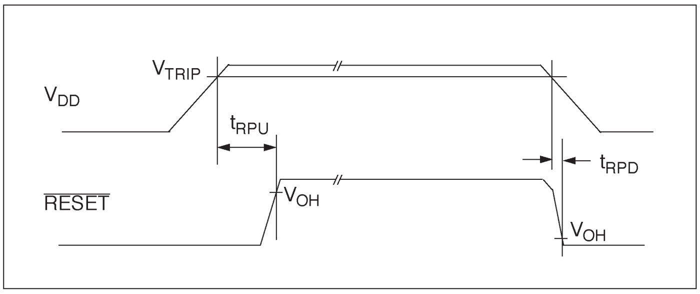


Figure 2. Timing diagram — reset at power up and power down.

Low voltage conditions on microcontroller systems can give problems in many situations. If for example the supply voltage to a system has a long time constant, the controller will at some point be storing and reading data from SRAM when there is insufficient supply voltage to sustain the SRAM data. This will produce indeterminate results and probable system failure. System brown-outs occur during operation and these supply voltage dips or glitches can be troublesome if, for instance they occur while the controller is writing to EEPROM. These failures are by their nature unpredictable and lead to an unreliable controller system.

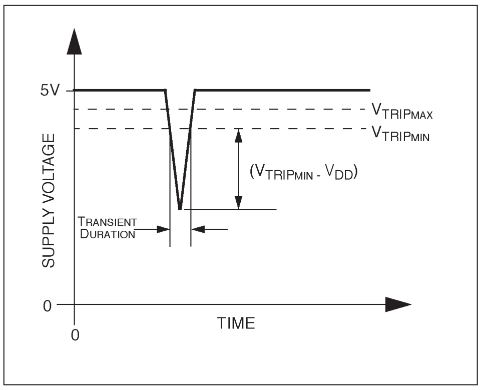
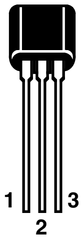


Figure 3. Typical transient response — short duration transients will not cause a reset.

Microcontroller voltage supervisory circuits have been developed to combat these problems. The MPC120/130 from Microchip Technology is just such a device. At system power–up it ensures that the microcontroller is held in its reset condition until the system voltage has reached its proper level and stabilised. If the supply voltage dips below the trip voltage during normal operation, the $\overline{\text{RESET}}$ output will go active Low to ensure a clean reset of the controller. The block diagram for this device is shown in **Figure 1.** The device is available with a choice of seven different trip voltages and many different package outlines. The $\overline{\text{RESET}}$ output of this device is open drain and the MCP130 has a built in pull-up resistor of 5 kΩ. The MCP120 has no pull-up resistor but is otherwise identical, it should be used for controllers that already have an internal pull-up resistor on their reset input.

Figure 2 shows the timing diagram of the MPC120/130 RESET signal at supply switch-on and power down. As the supply voltage rises above the trip voltage (V_{TRIP}) the chip allows a time period t_{RPU} (typically 350 ms) before it will release the $\overline{\text{RESET}}$ line. At power down,

Component identification: MCP120/130(T) - xxx b ml /pp					
Part MCP120/130(T)	MCP120:		Open drain		
	MCP120T:		Open drain, band and roll packaging		
	MCP130:		Open drain & pullup		
	MCP130T:		Open drain & pullup, band and roll packaging		
Thresholds xxx	270		$2.55 \leq V_{TRIP} \leq 2.70$		
	300		$2.85 \leq V_{TRIP} \leq 3.00$		
	315		$3.00 \leq V_{TRIP} \leq 3.15$		
	450		$4.25 \leq V_{TRIP} \leq 4.50$		
	460		$4.35 \leq V_{TRIP} \leq 4.60$		
	475		$4.50 \leq V_{TRIP} \leq 4.75$		
	485		$4.60 \leq V_{TRIP} \leq 4.85$		
Pinout (TO-92 only, front view, from top)	D		1: RST	2: V_{DD}	3: V_{SS}
	F		1: V_{SS}	2: RST	3: V_{DD}
	G		1: V_{DD}	2: V_{SS}	3: RST
	H		1: V_{DD}	2: RST	3: V_{SS}
Temperature range I	I		–40 to +85 °C		
Case/pp	TO	TO-92, 3-pin	See pinout		
	TT	SOT-23, 3-pin	1: RST	1: V_{DD}	1: V_{SS}
	SN	SOIC, 8-pin	1: RST	2:V_{DD}	4:V_{SS}
			(all other pins not connected)		



when the supply voltage drops below V_{TRIP} a reset will be generated within typically 10 μs.

An important consideration of Power On Reset circuits generally is the minimum pulse width of the transient required to cause a reset. **Figure 3** shows a typical voltage transient below the trip point vs. transient duration. You can see that the deeper the transient falls below the trip point the shorter it needs to be to generate a reset.

A 100 nF bypass capacitor mounted close to the V_{DD} pin will assist in providing additional transient immunity.

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Typical data (V_{DD} = 1.0 to 5.5 V), T = –40 to +85 °C, typical values for 5.0 V, 25 °C)						
Parameter	**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Supply voltage	V_{DD}		1.0		5.5	V
Supply current	I_{DD}	V_{DD}=5.5 V, no load		45	60	µA
Trip voltage	V_{TRIP}	MCP1x0-270	2.55	2.625	2.70	V
		MCP1x0-300	2.85	2.925	3.00	
		MCP1x0-315	3.00	3.075	3.15	
		MCP1x0-450	4.25	4.375	4.50	
		MCP1x0-460	4.35	4.475	4.60	
		MCP1x0-475	4.50	4.625	4.75	
		MCP1x0-485	4.60	4.725	4.85	
RESET Low voltage	V_{OL}	MCP1x0-...315, I_{OL}=3.2 mA, V_{DD}=$V_{TRIP,MIN}$			0.4	V
		MCP1x0-450..., I_{OL}=8.5 mA, V_{DD}=$V_{TRIP,MIN}$			0.6	V
RESET High voltage	V_{OH}	MCP130-xxx	V_{DD} – 0.7		V	
Pull-up resistance		MCP130-xxx		5		kΩ
Output leakage current		MCP120-xxx		1		µA
Trip voltage hysteresis	V_{HYS}			50		mV
V_{DD} detection to $\overline{\text{RESET}}$ inactive	t_{RPU}		150	350	700	ms
V_{DD} detection to $\overline{\text{RESET}}$	t_{RPD}	V_{DD} from $V_{TRIPMAX}$+250 mV to $V_{TRIPMIN}$-250 mV		10		µs
Absolute maximum values						
V_{DD}	7.0 V					
All inputs and outputs	– 0.6 V ... V_{DD}+1.0 V					
Operating temperature	– 65...+125 °C					
ESD protection on all inputs	≥ 2 kV					